

Figure Captions

[Figure 1](#). Airstream configuration as depicted in the classic cyclone model (adapted from *Carlson*, 1980). Airstreams are the warm conveyor belt (WCB), cold conveyor belt (CCB), and dry intrusion (DI). The surface low-pressure center is indicated with L.

[Figure 2](#). Sample MM5 domain configuration for the March 21, 2001 simulation.

[Figure 3](#). MM5-derived versus aircraft measured wind speed (m s^{-1}) at 1-min intervals along all flights used in this study.

[Figure 4](#). MM5 sea level pressure forecast for a) 0000 UTC March 18 (F+48), b) 0000 UTC March 19 (F+72), c) 0000 UTC March 20 (F+96), and d) 0000 UTC March 21 (F+120). Positions of cyclone centers are indicated by C1, C2, and C3. L and A indicate positions of other cyclone and anticyclone centers. The position of the cold front crossed by the P-3B and DC-8 is indicated by the dashed curve in d).

[Figure 5](#). Reverse domain filling (RDF) of 36-hour maximum pressure (hPa) at 0300 UTC 21 March, 2001 for a) 700 hPa, b) 600 hPa, c) 500 hPa, and d) 400 hPa. Shaded regions indicate air with a boundary layer history. Flight tracks (arrows) and surface cold front position (curved line) are indicated.

[Figure 6](#). Schematic of 3.5 day paths of the rising airstreams arriving at 0300 UTC 21 March, 2001 and having a 36-hour boundary layer history. Filled circles indicate the positions of the airstreams 36-hours back.

[Figure 7](#). MM5 equivalent potential temperature (K – shaded) and sea level pressure (hPa) forecast valid at 0300 UTC March 21 for a) 600 hPa and b) 700 hPa. Positions of the seven rising airstreams in Figure 6 are indicated.

[Figure 8 a\)](#) Cross section of RDF 36-hour boundary layer air (hPa) at 0300 UTC 21 March, 2001 along P-3B vertical profiles 1 and 2 (RDF feature B in Fig. 5). [b\)](#) Mixing ratios of ethyne (pptv), propane (pptv), and CO (ppbv) along P-3B profile 1. [c\)](#) As in b) but for P-3B profile 2.

[Figure 9](#). 3.5-day backward trajectories from a) P-3B profile 1, and b) profile 2. Trajectories arrive at 0300 UTC 21 March 2001 at RDF feature B. U and P denote unpolluted and polluted airstreams, respectively.

[Figure 10](#). a) Cross section of RDF 36-hour boundary layer air (hPa) at 0300 UTC 21 March, 2001 along DC-8 profile 1 (RDF feature D in Fig. 5). b) Mixing ratios of ethyne (pptv), propane (pptv), and CO (ppbv) along DC-8 profile 1.

[Figure 11](#). 3.5 day backward trajectories from DC-8 profile 1. Trajectories arrive at 0300 UTC 21 March, 2001 at RDF feature D. U and P denote unpolluted and polluted airstreams, respectively.

[Figure 12](#). a) Cross section of RDF 36-hour boundary layer air (hPa) at 0300 UTC 21 March, 2001 along DC-8 profile 2 (RDF feature D in Fig. 5). b) Mixing ratios of ethyne (pptv), propane (pptv), and CO (ppbv) along DC-8 profile 2.

[Figure 13](#). MM5 sea level pressure forecast for a) 0000 UTC April 1 (F+48), b) 0000 UTC April 2 (F+72), c) 0000 UTC April 3 (F+96), and d) 0000 UTC April 4 (F+120). C indicates the position of the cyclone center. L and A indicate positions of other low-pressure and anticyclone centers. The positions of cold fronts on April 4 are indicated by dashed curves.

[Figure 14](#). Reverse domain filling (RDF) of 36-hour maximum pressure (hPa) at 0300 UTC 4 April, 2001 for a) 700 hPa, b) 600 hPa, c) 500 hPa, and d) 400 hPa. Shaded regions indicate air with a boundary layer history. Flight track (arrows) and surface cold front positions (curved lines) are indicated.

[Figure 15](#). Schematic of 3.5 day paths of the rising airstreams arriving at 0300 UTC 4 April, 2001 and having a 36-hour boundary layer history. Filled circles indicate the positions of the airstreams 36-hours back..

[Figure 16](#). a) Cross section of RDF 36-hour boundary layer air (hPa) at 0300 UTC 4 April, 2001 along P-3B profile 1 (RDF feature A1 in Fig. 14). b) Mixing ratios of ethyne (pptv), propane (pptv), and CO (ppbv) along P-3B profile 1.

[Figure 17 a\)](#). Cross section of RDF 36-hour boundary layer air (hPa) at 0300 UTC 4 April, 2001 along P3-B profiles 2 and 3 (RDF feature B in Fig. 14). [b\)](#) Mixing ratios of ethyne (pptv), propane (pptv), and CO (ppbv) along P-3B profile 2. [c\)](#) As in b) but for P-3B profile 3.

[Figure 18](#). 3.5-day backward trajectories and CO mixing ratios (ppbv) from P-3B profile 2. Trajectories arrive at 0300 UTC 4 April 2001 at RDF feature B.

[Figure 19](#). 3.5-day backward trajectories from P-3B profile 3. Trajectories arrive at 0300 UTC 4 April, 2001 at RDF feature B.